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May 11, 2018

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Re: GN Docket No. 17-183, *Expanding Flexible Use in Mid-Band Spectrum between 3.7 and 24 GHz*
Ex Parte Communication

Dear Ms. Dortch:

Wireless Application, Corp.(WAC) is writing in support of the Ex Parte Communication filed by the Fixed Wireless Communications Coalition (FWCC) on March 13, 2018 in opposition to the study "Frequency Sharing for Radio Local Area Networks in the 6 GHz Band" prepared by RKF Engineering Services, LLC filed on January 26, 2018.

WAC is an award winning telecom consulting company and one of the major frequency coordinators in the US. Wireless Applications, Corp. was established in 1999 and is currently located in Bellevue, WA. We license our design tool, SiteSync Pro, and provide a valuable service to our clients that include: Frequency Analysis/Interference Analysis, Frequency Coordination, FCC Licensing, Frequency Protection, Tower Searching and GIS Analysis/Mapping. We service wireless companies of varying sizes, including both regional and national carriers.

Utilizing our design tool, WAC has been able to design long haul paths with tight tolerances in spectrally congested locations while maintaining the client's target reliability. The level of complexities for microwave interference algorithms for very close paths along the straight line has made us the best in the industry. WAC is a member of the National Spectrum Managers Association (NSMA) and follows the recommendations they have created for the services above.

WAC relies on having up-to-date coordination data and licensing databases to ensure that we can find new usable channels for our clients, maintain their existing networks and avoid new interference from new incoming networks. Even allowing "lower" power unlicensed transmitters will negatively impact our ability to detect new interference into existing path as well as find interference free new channels. 6 GHz in particular is a very congested and desirable frequency band for microwave communications which requires careful planning when introducing new transmitters and receivers.

6 GHz - Spectrally Dense

To illustrate how congested the 6 GHz band currently is with fixed microwave, we have provided the figure below, which is showing 34 fixed microwave links crossing a radius of 1 mile in a metropolitan area where it is expected for many unlicensed 6 GHz devices to be deployed.

For these licensed entities to be online and transmitting, they went through months of careful planning and engineering. Each of these entities had to analyze what frequency channels were available in their desired band, coordinate it with all nearby proposed/FCC licensed paths and mitigate any potential interference the link might introduce before turning online. If the link does introduce inference when turned up, it would be easy for the victim to identify who the interferer is as their path and buildout deadline are in the FCC's database.

By introducing unlicensed paths in spectrally congested locations, interference is bound to happen. This is especially so when line of sight between the interferer and victim is present. Allowing unlicensed 6 GHz paths wouldn't be an efficient use of the spectrum. The impact will be evident in the simulation shown later in this report.

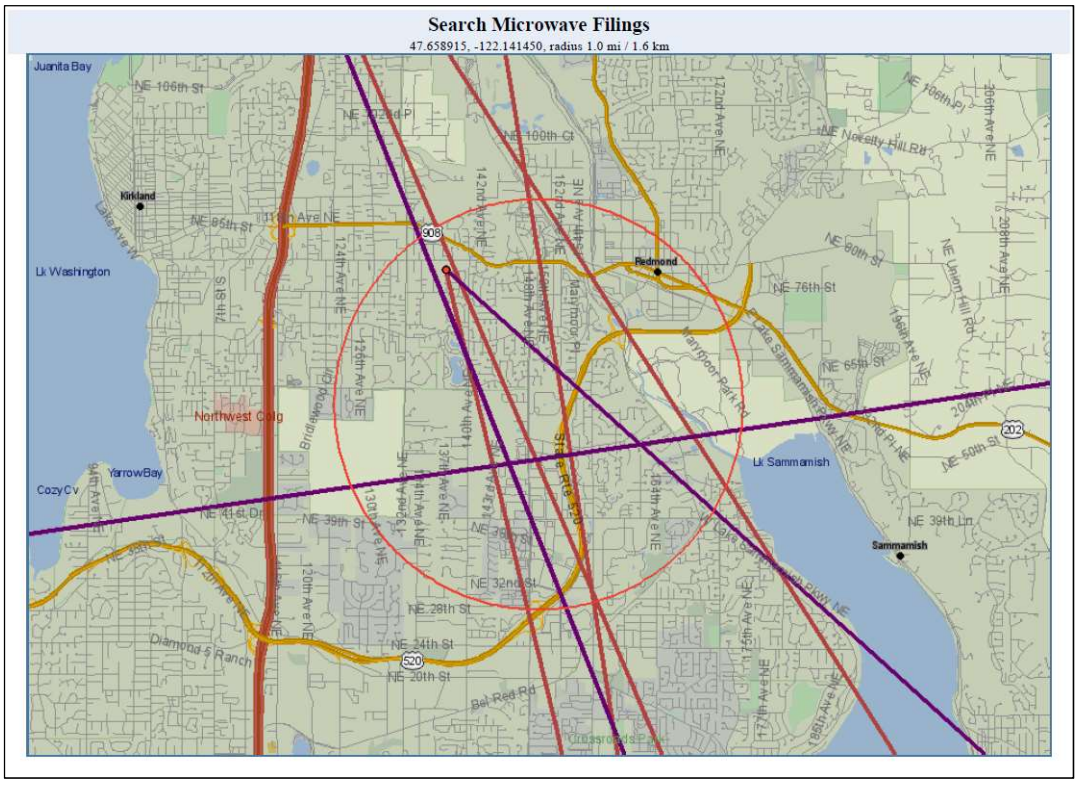


Figure 2 - Existing 6GHz Band fixed Point-to-Point Microwave Links

Search Microwave Filings

47.658915, -122.141450, radius 1.0 mi / 1.6 km

Band 6GHz

#	Freq (MHz)	Call Sign	Coordinates	Path Length	Rad Height	Owner
1	6034.15000000	WPNH444	A: 48.130361, -122.249861 B: 47.543139, -122.110111	41.09 mi 66.12 km	A: 145.01 ft / 44.20 m B: 194.88 ft / 59.40 m	Puget Sound Energy, Inc.
2	6152.75000000	WQGX277	A: 47.746417, -122.201528 B: 47.504306, -122.047694	18.21 mi 29.30 km	A: 124.02 ft / 37.80 m B: 124.02 ft / 37.80 m	KING COUNTY DEPARTMENT OF TRANSPORTATION, METRO TRANSIT DIVISION
3	6152.75000000	WQGX277	A: 47.746417, -122.201528 B: 47.504306, -122.047694	18.21 mi 29.30 km	A: 124.02 ft / 37.80 m B: 124.02 ft / 37.80 m	KING COUNTY DEPARTMENT OF TRANSPORTATION, METRO TRANSIT DIVISION
4	6152.75000000	WQGX277	A: 47.746417, -122.201528 B: 47.504306, -122.047694	18.21 mi 29.30 km	A: 124.02 ft / 37.80 m B: 124.02 ft / 37.80 m	KING COUNTY DEPARTMENT OF TRANSPORTATION, METRO TRANSIT DIVISION
5	6152.75000000	WQGX277	A: 47.746417, -122.201528 B: 47.504306, -122.047694	18.21 mi 29.30 km	A: 124.02 ft / 37.80 m B: 124.02 ft / 37.80 m	KING COUNTY DEPARTMENT OF TRANSPORTATION, METRO TRANSIT DIVISION
6	6152.75000000	WQGX277	A: 47.746417, -122.201528 B: 47.504306, -122.047694	18.21 mi 29.30 km	A: 124.02 ft / 37.80 m B: 124.02 ft / 37.80 m	KING COUNTY DEPARTMENT OF TRANSPORTATION, METRO TRANSIT DIVISION
7	6152.75000000	WQGX277	A: 47.746417, -122.201528 B: 47.504306, -122.047694	18.21 mi 29.30 km	A: 124.02 ft / 37.80 m B: 124.02 ft / 37.80 m	KING COUNTY DEPARTMENT OF TRANSPORTATION, METRO TRANSIT DIVISION
8	6805.00000000	WNTS646	A: 47.746194, -122.201778 B: 47.616472, -122.125389	9.64 mi 15.52 km	A: 115.16 ft / 35.10 m B: 84.97 ft / 25.90 m	EASTSIDE PUBLIC SAFETY COMMUNICATIONS AGENCY
9	5945.20000000	WNTS646	A: 47.746194, -122.201778 B: 47.504528, -121.972611	19.83 mi 31.92 km	A: 115.16 ft / 35.10 m B: 60.04 ft / 18.30 m	EASTSIDE PUBLIC SAFETY COMMUNICATIONS AGENCY
10	6805.00000000	WNTS646	A: 47.746194, -122.201778 B: 47.504528, -121.972611	19.83 mi 31.92 km	A: 115.16 ft / 35.10 m B: 60.04 ft / 18.30 m	EASTSIDE PUBLIC SAFETY COMMUNICATIONS AGENCY
11	6820.00000000	WPOS745	A: 47.696194, -121.690944 B: 47.631472, -122.355389	31.33 mi 50.42 km	A: 95.14 ft / 29.00 m B: 127.95 ft / 39.00 m	SEATTLE CITY LIGHT
12	6093.45000000	KOW42	A: 47.674250, -122.157056 B: 47.543139, -122.110111	9.32 mi 15.00 km	A: 115.16 ft / 35.10 m B: 154.86 ft / 47.20 m	Puget Sound Energy, Inc.
13	6093.45000000	KOW42	A: 47.674250, -122.157056 B: 47.543139, -122.110111	9.32 mi 15.00 km	A: 115.16 ft / 35.10 m B: 154.86 ft / 47.20 m	Puget Sound Energy, Inc.
14	6725.00000000	KOW42	A: 47.674250, -122.157056 B: 47.470083, -121.821222	21.11 mi 33.97 km	A: 115.16 ft / 35.10 m B: 140.09 ft / 42.70 m	Puget Sound Energy, Inc.
15	6725.00000000	KOW42	A: 47.674250, -122.157056 B: 47.470083, -121.821222	21.11 mi 33.97 km	A: 115.16 ft / 35.10 m B: 140.09 ft / 42.70 m	Puget Sound Energy, Inc.
16	6725.00000000	KOW42	A: 47.674250, -122.157056 B: 47.470083, -121.821222	21.11 mi 33.97 km	A: 115.16 ft / 35.10 m B: 140.09 ft / 42.70 m	Puget Sound Energy, Inc.
17	6725.00000000	KOW42	A: 47.674250, -122.157056 B: 47.470083, -121.821222	21.11 mi 33.97 km	A: 115.16 ft / 35.10 m B: 140.09 ft / 42.70 m	Puget Sound Energy, Inc.
18	6660.00000000	KOD97	A: 47.631472, -122.355389 B: 47.696194, -121.690944	31.33 mi 50.42 km	A: 127.95 ft / 39.00 m B: 94.16 ft / 28.70 m	SEATTLE CITY LIGHT
19	6645.00000000	WNTS642	A: 47.616750, -122.125556 B: 47.746194, -122.201778	9.63 mi 15.49 km	A: 84.97 ft / 25.90 m B: 115.16 ft / 35.10 m	EASTSIDE PUBLIC SAFETY COMMUNICATIONS AGENCY
20	6286.19000000	KOW41	A: 47.543139, -122.110111 B: 48.130361, -122.249861	41.09 mi 66.12 km	A: 194.88 ft / 59.40 m B: 145.01 ft / 44.20 m	Puget Sound Energy, Inc.
21	6345.49000000	KOW41	A: 47.543139, -122.110111 B: 47.674250, -122.157056	9.32 mi 15.00 km	A: 154.86 ft / 47.20 m B: 115.16 ft / 35.10 m	Puget Sound Energy, Inc.
22	6345.49000000	KOW41	A: 47.543139, -122.110111 B: 47.674250, -122.157056	9.32 mi 15.00 km	A: 154.86 ft / 47.20 m B: 115.16 ft / 35.10 m	Puget Sound Energy, Inc.
23	6197.24000000	WNTS645	A: 47.504528, -121.972611 B: 47.746194, -122.201778	19.83 mi 31.92 km	A: 60.04 ft / 18.30 m B: 115.16 ft / 35.10 m	EASTSIDE PUBLIC SAFETY COMMUNICATIONS AGENCY
24	6645.00000000	WNTS645	A: 47.504528, -121.972611 B: 47.746194, -122.201778	19.83 mi 31.92 km	A: 60.04 ft / 18.30 m B: 115.16 ft / 35.10 m	EASTSIDE PUBLIC SAFETY COMMUNICATIONS AGENCY
25	6595.00000000	WQGX264	A: 47.504306, -122.047694 B: 47.746417, -122.201528	18.21 mi 29.30 km	A: 124.02 ft / 37.80 m B: 124.02 ft / 37.80 m	KING COUNTY DEPARTMENT OF TRANSPORTATION, METRO TRANSIT DIVISION
26	6595.00000000	WQGX264	A: 47.504306, -122.047694 B: 47.746417, -122.201528	18.21 mi 29.30 km	A: 124.02 ft / 37.80 m B: 124.02 ft / 37.80 m	KING COUNTY DEPARTMENT OF TRANSPORTATION, METRO TRANSIT DIVISION
27	6595.00000000	WQGX264	A: 47.504306, -122.047694 B: 47.746417, -122.201528	18.21 mi 29.30 km	A: 124.02 ft / 37.80 m B: 124.02 ft / 37.80 m	KING COUNTY DEPARTMENT OF TRANSPORTATION, METRO TRANSIT DIVISION
28	6595.00000000	WQGX264	A: 47.504306, -122.047694 B: 47.746417, -122.201528	18.21 mi 29.30 km	A: 124.02 ft / 37.80 m B: 124.02 ft / 37.80 m	KING COUNTY DEPARTMENT OF TRANSPORTATION, METRO TRANSIT DIVISION
29	6595.00000000	WQGX264	A: 47.504306, -122.047694 B: 47.746417, -122.201528	18.21 mi 29.30 km	A: 124.02 ft / 37.80 m B: 124.02 ft / 37.80 m	KING COUNTY DEPARTMENT OF TRANSPORTATION, METRO TRANSIT DIVISION
30	6595.00000000	WQGX264	A: 47.504306, -122.047694 B: 47.746417, -122.201528	18.21 mi 29.30 km	A: 124.02 ft / 37.80 m B: 124.02 ft / 37.80 m	KING COUNTY DEPARTMENT OF TRANSPORTATION, METRO TRANSIT DIVISION
31	6555.00000000	WNEF852	A: 47.470000, -121.821111 B: 47.674250, -122.157056	21.11 mi 33.98 km	A: 140.09 ft / 42.70 m B: 115.16 ft / 35.10 m	Puget Sound Energy, Inc.
32	6555.00000000	WNEF852	A: 47.470000, -121.821111 B: 47.674250, -122.157056	21.11 mi 33.98 km	A: 140.09 ft / 42.70 m B: 115.16 ft / 35.10 m	Puget Sound Energy, Inc.
33	6555.00000000	WNEF852	A: 47.470000, -121.821111 B: 47.674250, -122.157056	21.11 mi 33.98 km	A: 140.09 ft / 42.70 m B: 115.16 ft / 35.10 m	Puget Sound Energy, Inc.
34	6555.00000000	WNEF852	A: 47.470000, -121.821111 B: 47.674250, -122.157056	21.11 mi 33.98 km	A: 140.09 ft / 42.70 m B: 115.16 ft / 35.10 m	Puget Sound Energy, Inc.

Figure 3 - List of Existing 6 GHz Entities

Interference Analysis

The report shown on the following page is a typical interference report showing all necessary information to calculate interference: path distances, Transmitting Interferer EIRP, free-space loss, antenna models, radio models, discrimination angles of the antennas based on azimuth and tilt and the resulting antenna discrimination value at those angles, the Threshold to interference value from the radio manufacturer (for the victim), the Receiver Threshold of the victim radio.

The above listed data is used to calculate the Carrier to Interferer (C/I) Objective and the C/I actual levels. The difference between these two values (margin) is how we determine the level of interference. This margin level can be increased with path-loss calculations based on the terrain between the points unless the antennas are LOS (Line-of-sight; no obstructions).

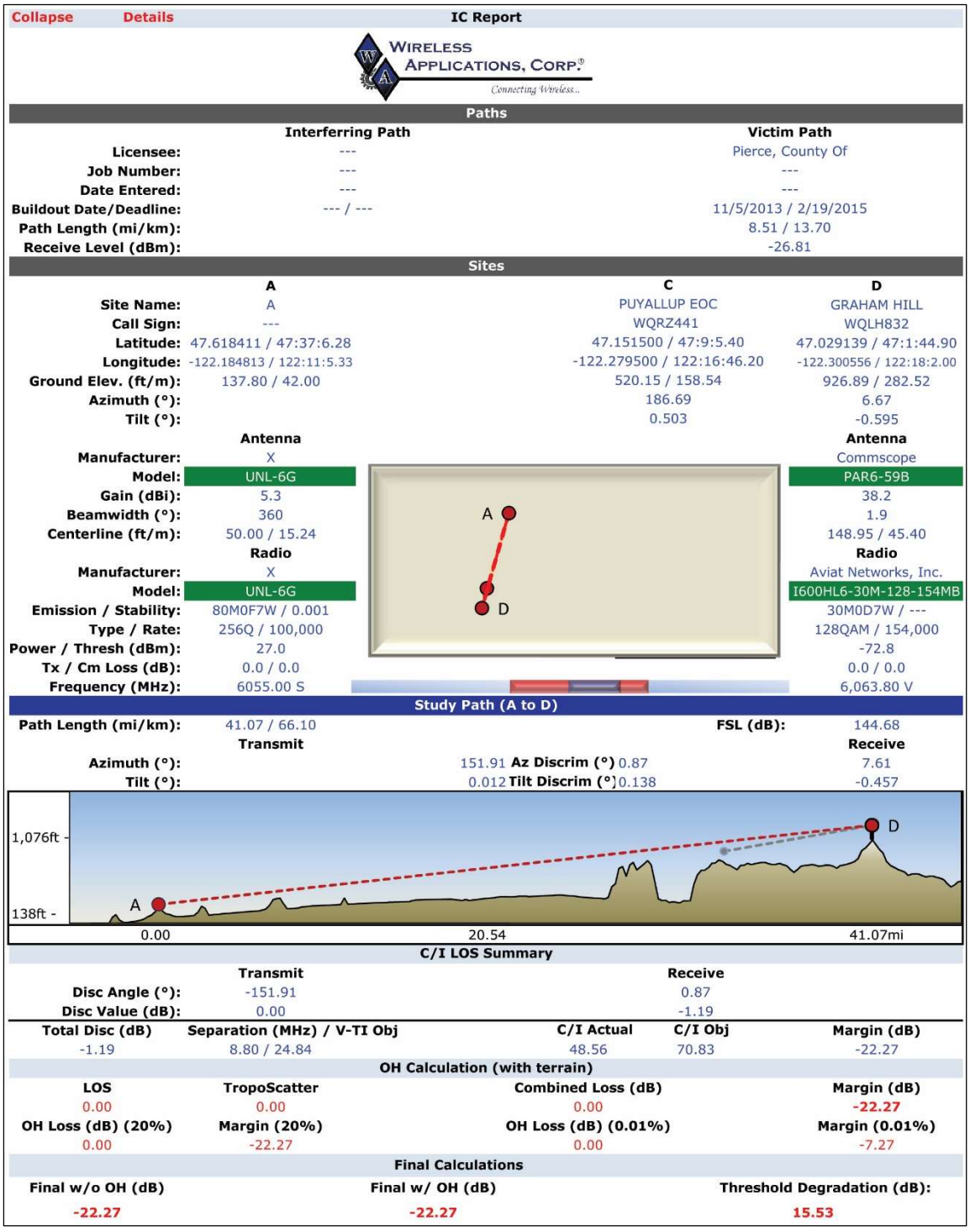
The goal of this interference calculation is to have a margin above -1; this value means the interference from the "Interferer Transmitter" to the "Receiver Victim" will not impacting the fade margin by more than 1dB. The 'Final value w/ OH' value is the margin + Over Horizon (OH) loss calculated from the terrain between the 2 points. From this value we can then convert to the receiver threshold degradation the victim receiver would experience using the following equations (as found in TIA Document Number: TR45.WGMS-180323-418, Chapter 10):

$$\text{Ifactor (dB)} = \text{I (dBm)} - \text{ITI (dBm)} \qquad (10\text{-}1)$$

$$\text{DT (dB)} = 10 \log_{10} [1 + (0.259 * 10^{(\text{Ifactor}/10)})] \qquad (10\text{-}2)$$

As an example report on page 5, the unlicensed RLAN transmitter (represented in the report as site 'A') is interfering with the existing licensed and constructed path: PUYALLUP EOC – GRAHAM HILL, with GRAHAM HILL as the victim. The interference case is LOS (no obstructions) which is verified in the path profile image in the middle of the report. The Unlicensed RLAN transmitter has an EIRP of 32.3dBm (antenna gain of 5.3dB + transmit power of 27dBm – losses of 0dB) and creates a Final w/ OH value of -22.27B, which converts to a receiver threshold degradation of 15.53dB!

This level of receiver threshold degradation, 15.53 dB, is well beyond the 1 dB degradation limit defined in the RKF proposal and would severely impact the reliability of this communication link if not completely 'kill' the link. WAC has compiled a complete analysis on the following pages that document how this (or any) unlicensed transmitter in 6GHz would severely impact multiple existing microwave links regardless of which channel they operate on.



Collapse Details **IC Report**

WIRELESS APPLICATIONS, CORP.® Connecting Wireless...

Paths

	Interferring Path	Victim Path
Licensee:	---	Pierce, County Of
Job Number:	---	---
Date Entered:	---	---
Buildout Date/Deadline:	--- / ---	11/5/2013 / 2/19/2015
Path Length (mi/km):		8.51 / 13.70
Receive Level (dBm):		-26.81

Sites

	A	C	D
Site Name:	A	PUYALLUP EOC	GRAHAM HILL
Call Sign:	---	WQRZ441	WQLH832
Latitude:	47.618411 / 47:37:6.28	47.151500 / 47:9:5.40	47.029139 / 47:1:44.90
Longitude:	-122.184813 / 122:11:5.33	-122.279500 / 122:16:46.20	-122.300556 / 122:18:2.00
Ground Elev. (ft/m):	137.80 / 42.00	520.15 / 158.54	926.89 / 282.52
Azimuth (°):		186.69	6.67
Tilt (°):		0.503	-0.595
Antenna			**Antenna**
Manufacturer:	X		Commscope
Model:	UNL-6G		PAR6-59B
Gain (dBi):	5.3		38.2
Beamwidth (°):	360		1.9
Centerline (ft/m):	50.00 / 15.24		148.95 / 45.40
Radio			**Radio**
Manufacturer:	X		Aviat Networks, Inc.
Model:	UNL-6G		I600HL6-30M-128-154MB
Emission / Stability:	80M0F7W / 0.001		30M0D7W / ---
Type / Rate:	256Q / 100,000		128QAM / 154,000
Power / Thresh (dBm):	27.0		-72.8
Tx / Cm Loss (dB):	0.0 / 0.0		0.0 / 0.0
Frequency (MHz):	6055.00 S		6,063.80 V

Study Path (A to D)

Path Length (mi/km):	41.07 / 66.10	FSL (dB):	144.68
	Transmit		**Receive**
Azimuth (°):	151.91	**Az Discrim (°)** 0.87	7.61
Tilt (°):	0.012	**Tilt Discrim (°)** 0.138	-0.457

1,076ft - 138ft - A D 0.00 20.54 41.07mi

C/I LOS Summary

	Transmit	Receive
Disc Angle (°):	-151.91	0.87
Disc Value (dB):	0.00	-1.19

Total Disc (dB)	Separation (MHz) / V-TI Obj	C/I Actual	C/I Obj	Margin (dB)
-1.19	8.80 / 24.84	48.56	70.83	-22.27

OH Calculation (with terrain)

LOS	TropoScatter	Combined Loss (dB)	Margin (dB)
0.00	0.00	0.00	-22.27
OH Loss (dB) (20%)	**Margin (20%)**	**OH Loss (dB) (0.01%)**	**Margin (0.01%)**
0.00	-22.27	0.00	-7.27

Final Calculations

Final w/o OH (dB)	Final w/ OH (dB)	Threshold Degradation (dB):
-22.27	-22.27	15.53

Figure 1 - Interference Report

The interference report on this page is being provided to illustrate how we are calculating interference in our simulation. This example interference case is also one of the many cases we found in the results of the Seattle area study found on the following pages.

Interference from Proposed Unlicensed 6 GHz - Simulation Configuration

The next several pages (8 through 12) are reports meant to demonstrate that each unlicensed transmitter allowed to operate will create numerous potential interference cases with the existing licensed microwave paths. Following the information provided by RKF, they specified that 10% of the anticipated unlicensed radio would use 20MHz channels, 10% would use 40MHz channels, 50% would use 80MHz channels and the remaining 30% would be using 160MHz channels. For the simulation we selected 80MHz channels (the largest stated group).

The RKF document shows several scenarios of the proposed RLAN and the transmit levels of each: Indoor Enterprise AP, Indoor Consumer AP, Indoor High-Performance Gaming Router, Indoor and Outdoor Client, Outdoor High-Power AP and Outdoor Low Power AP. For the simulation we selected the Outdoor High-Power AP design (leaving out the MIMO Gain of 3 dB); 27.0dBm transmit power with the 5.3dB antenna gain making the EIRP 32.3dBm. The simulation is assuming the antennas are omnidirectional and have no reliable discrimination. All other aspects of typical point-to-point interference analysis were utilized.

The simulation was performed by selecting 2 random locations in the 5 cities mentioned in the previous objections from the FWCC: Chicago, Houston, Los Angeles, Seattle and Washington DC. Once the points were dropped on the map, with help from satellite imagery, the points were moved to nearby structures. Our objective is to demonstrate that a theoretical unlicensed transmitter can be 'dropped' in any of these cities and there will be a significant introduction of interference across all nearby licensed paths for any of the channels that the unlicensed transmitter decides to use. We did not search out 2 of the worst locations, nor are these the best locations; they are meant to demonstrate that just "dropping" a point randomly on the map has a significant impact.

Figure 4 - Five cities WAC selected for simulation: (Listed furthest West to East) Seattle, Los Angeles, Houston, Chicago and Washington DC.

WAC calculates interference cases on a single transmitter to a single victim case. An interference analysis sweeping the 6 GHz band showing all anticipated interference cases could result as a report with too many pages. To make this simulation more digestible, four ranges of interference levels are shown:

-50 to -40 (dB)	-40 to -30 (dB)	-30 to -20 (dB)	-20 to -10 (dB)	-10 to -3 (dB)

The interference ranges were also converted into receiver threshold degradation ranges to show the immediate impact this unlicensed transmitter would have:

43.1 to 33.1 (dB)	33.1 to 23.2 (dB)	23.2 to 13.3 (dB)	13.3 to 4.9 (dB)	4.9 to 1.5 (dB)

The quantities listed in each cell are a count of unique existing licensed channels impacted by unlicensed Transmitter. WAC made sure to only tally a single channel on a path once (multiple modulations or a single modulation on a channel on a path were counted as one channel).

These simulations demonstrate the total impact of one unlicensed 6GHz transmitter in terms of severity of interference as well as how far-reaching the interference is. The tables show the total number of individual interference cases that fit into their category of interference for that specific channel. In these populated areas the majority of the proposed 80MHz channels for unlicensed 6 GHz created several interference cases with the existing licensed paths, each with an impact on their respective receiver threshold far exceeding 1dB. In some of the tables, each channel created multiple simultaneous interferences.

Interference from Proposed Unlicensed 6 GHz - Report Layout

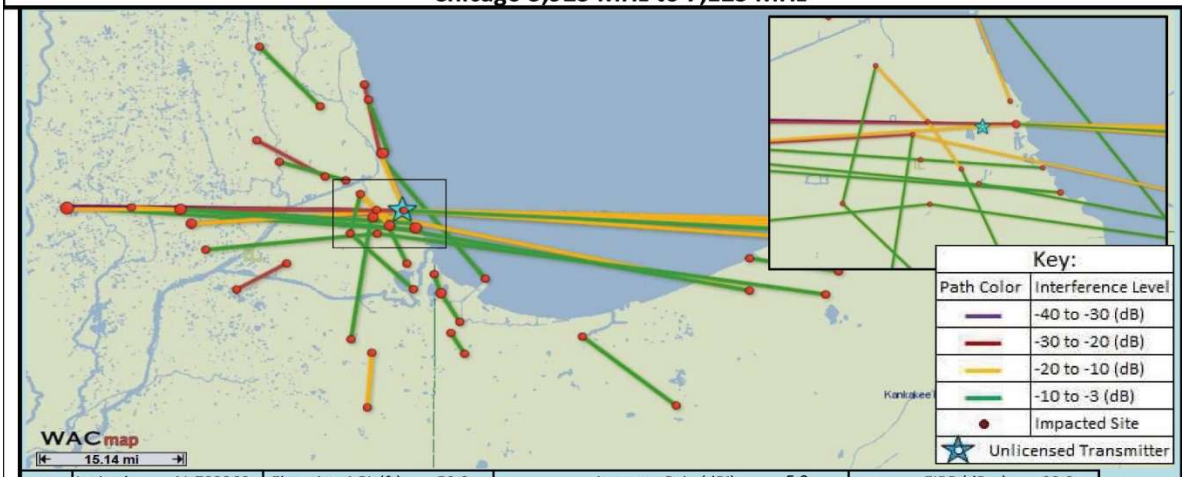
There are two maps on each page showing the unlicensed RLAN transmitter as the blue star and all impacted paths (each colored to match the respective level of interference). Accompanying the maps are tables showing some key details of the RLAN transmitter location and operation settings.

In the middle of the report is a table showing all 14 channel center frequencies for the proposed 80MHz channels on the left and there transmit EIRP setting. There are two tables to the right that each correspond to the one map. The tables and maps are filled with a background color (blue or orange) to help illustrate the table that corresponds to the map (the map on top corresponds to the table on the left and the map on the bottom corresponds to the table on the right). If there is a value greater than zero in the table, the cell is filled with the color that corresponds to that interference level, which matches the color that path is colored on the corresponding map.

The maps are meant to demonstrate how far-reaching the interference from the unlicensed transmitter is as well as the level of impact. The tables add a level of quantity of impact that cannot be expressed on the map as some of the impacted channels are on a shared link (for example one line on the map could represent 1or more 30MHz channels being impacted on that shared link).

Effected Licensed Paths from 2 Unlicensed Outdoor Transmitters

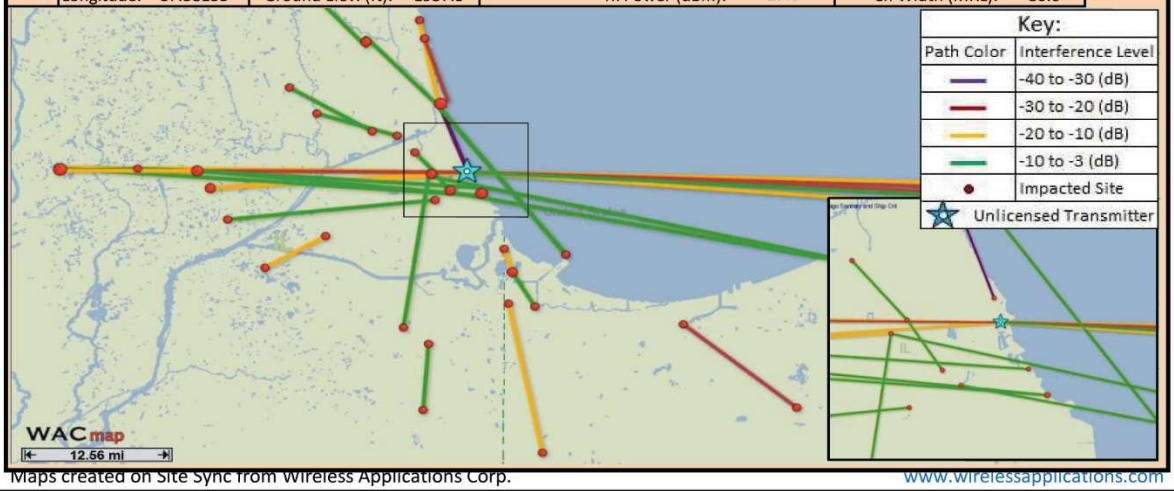
Chicago 5,925 MHz to 7,125 MHz



Latitude:	41.792269	Elevation AGL (ft):	50.0	Antenna Gain (dBi):	5.3	EIRP (dBm):	32.3
Longitude:	-87.603324	Ground Elev. (ft):	1937.5	Tx Power (dBm):	27.0	Ch Width (MHz):	80.0

Chicago				Unlicensed A (quantity of impacted channels)					Unlicensed B (quantity of impacted channels)				
Interference Level->				-50 to -40	-40 to -30	-30 to -20	-20 to -10	-10 to -3	-50 to -40	-40 to -30	-30 to -20	-20 to -10	-10 to -3
Receiver Threshold Degradation->				43.1 to 33.1 (dB)	33.1 to 23.2 (dB)	23.2 to 13.3 (dB)	13.3 to 4.9 (dB)	4.9 to 1.5 (dB)	43.1 to 33.1 (dB)	33.1 to 23.2 (dB)	23.2 to 13.3 (dB)	13.3 to 4.9 (dB)	4.9 to 1.5 (dB)
Ch #	Center Frequency (MHz)	Tx Power (dBm)	EIRP (dBm)										
Ch1	5975	27	32.3	0	0	1	3	1	0	0	1	3	1
Ch2	6055	27	32.3	0	0	1	1	3	0	0	1	1	1
Ch3	6135	27	32.3	0	0	1	3	2	0	1	1	1	3
Ch4	6215	27	32.3	0	2	1	3	1	0	0	0	2	5
Ch5	6295	27	32.3	0	0	0	3	6	0	0	2	3	4
Ch6	6375	27	32.3	0	0	4	5	1	0	0	3	4	3
Ch7	6455	27	32.3	0	0	0	0	0	0	0	0	0	0
Ch8	6535	27	32.3	0	0	0	2	0	0	0	0	2	0
Ch9	6615	27	32.3	0	0	2	1	2	0	0	3	2	1
Ch10	6695	27	32.3	0	0	3	2	0	0	0	1	2	1
Ch11	6775	27	32.3	0	1	2	2	5	0	0	0	2	3
Ch12	6855	27	32.3	0	0	1	1	0	0	0	0	0	2
Ch13	6935	27	32.3	0	0	0	0	0	0	0	0	0	0
Ch14	7015	27	32.3	0	0	0	0	0	0	0	0	0	0

Latitude:	41.795899	Elevation AGL (ft):	50.0	Antenna Gain (dBi):	5.3	EIRP (dBm):	32.3
Longitude:	-87.58153	Ground Elev. (ft):	1937.5	Tx Power (dBm):	27.0	Ch Width (MHz):	80.0

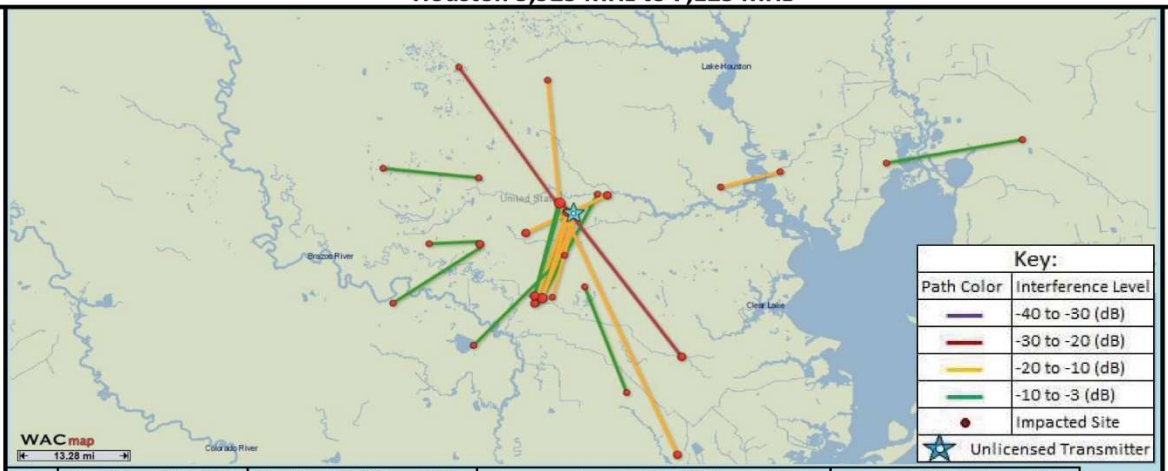


Maps created on Site Sync from Wireless Applications Corp. www.wirelessapplications.com

Figure 5 - Unlicensed 6 GHz Interference in Chicago

Effected Licensed Paths from 2 Unlicensed Outdoor Transmitters

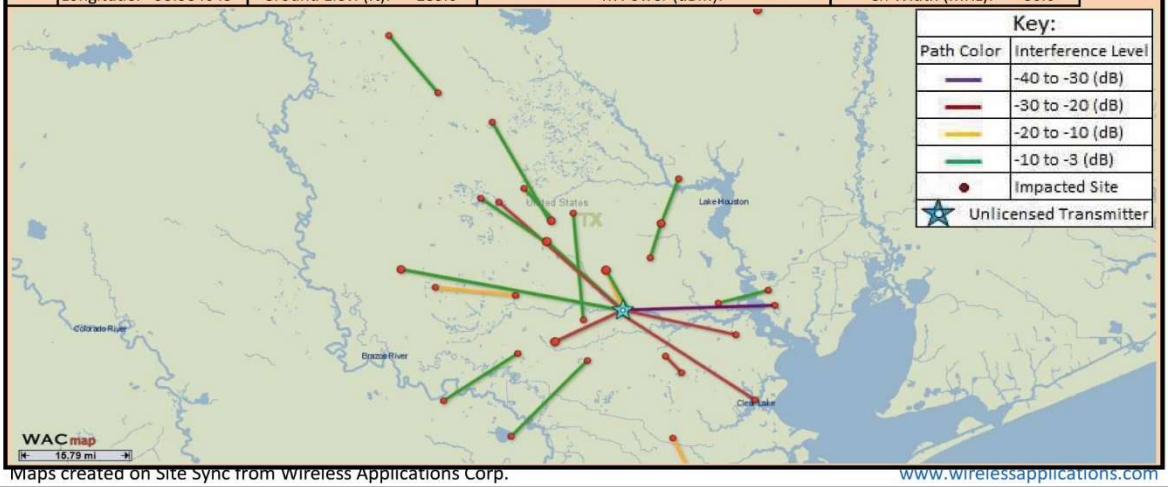
Houston 5,925 MHz to 7,125 MHz



Latitude:	29.715875	Elevation AGL (ft):	50.0	Antenna Gain (dBi):	5.3
Longitude:	-95.435107	Ground Elev. (ft):	172.2	Tx Power (dBm):	27.0
				EIRP (dBm):	32.3
				Ch Width (MHz):	80.0

Houston				Unlicensed A (quantity of impacted channels)					Unlicensed B (quantity of impacted channels)				
Interference Level->				-50 to -40	-40 to -30	-30 to -20	-20 to -10	-10 to -3	-50 to -40	-40 to -30	-30 to -20	-20 to -10	-10 to -3
Receiver Threshold Degradation->				43.1 to 33.1 (dB)	33.1 to 23.2 (dB)	23.2 to 13.3 (dB)	13.3 to 4.9 (dB)	4.9 to 1.5 (dB)	43.1 to 33.1 (dB)	33.1 to 23.2 (dB)	23.2 to 13.3 (dB)	13.3 to 4.9 (dB)	4.9 to 1.5 (dB)
Ch #	Center Frequency (MHz)	Tx Power (dBm)	EIRP (dBm)										
Ch1	5975	27	32.3	0	0	1	3	0	0	0	1	1	4
Ch2	6055	27	32.3	0	0	1	1	3	0	0	2	1	1
Ch3	6135	27	32.3	0	0	0	0	3	0	0	0	3	3
Ch4	6215	27	32.3	0	0	0	1	1	0	0	3	0	1
Ch5	6295	27	32.3	0	0	1	1	0	0	0	0	0	1
Ch6	6375	27	32.3	0	0	0	0	4	0	0	0	1	4
Ch7	6455	27	32.3	0	0	0	0	0	0	0	0	0	0
Ch8	6535	27	32.3	0	0	0	1	0	0	0	0	0	2
Ch9	6615	27	32.3	0	0	0	1	0	0	1	0	0	1
Ch10	6695	27	32.3	0	0	0	1	0	0	0	1	0	1
Ch11	6775	27	32.3	0	0	0	0	0	0	0	0	0	1
Ch12	6855	27	32.3	0	0	0	0	0	0	0	0	0	0
Ch13	6935	27	32.3	0	0	0	3	2	0	0	0	0	1
Ch14	7015	27	32.3	0	0	1	2	1	0	0	0	0	1

Latitude:	29.756247	Elevation AGL (ft):	50.0	Antenna Gain (dBi):	5.3
Longitude:	-95.384643	Ground Elev. (ft):	183.0	Tx Power (dBm):	27.0
				EIRP (dBm):	32.3
				Ch Width (MHz):	80.0

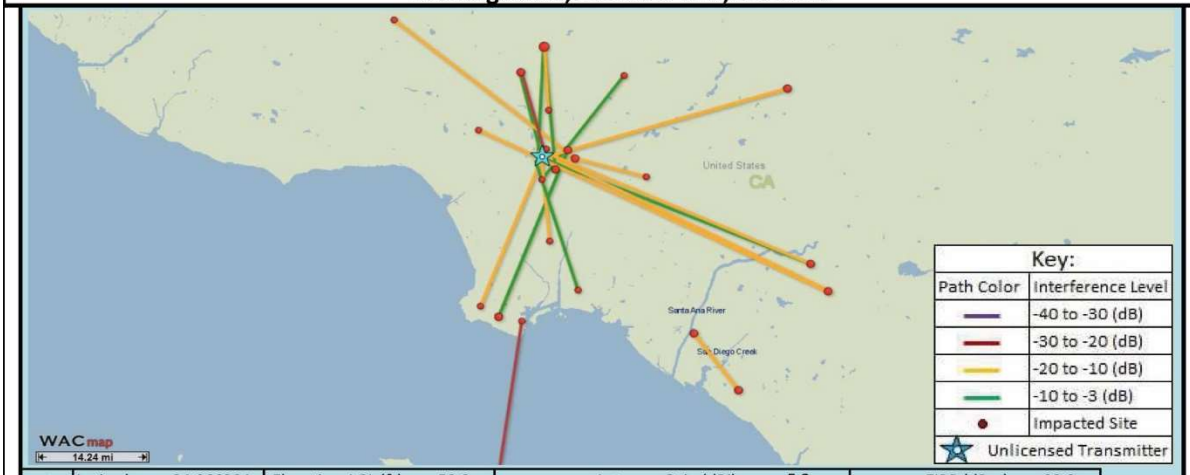


Maps created on Site Sync from Wireless Applications Corp. www.wirelessapplications.com

Figure 6 - Unlicensed 6 GHz Interference in Houston

Effected Licensed Paths from 2 Unlicensed Outdoor Transmitters

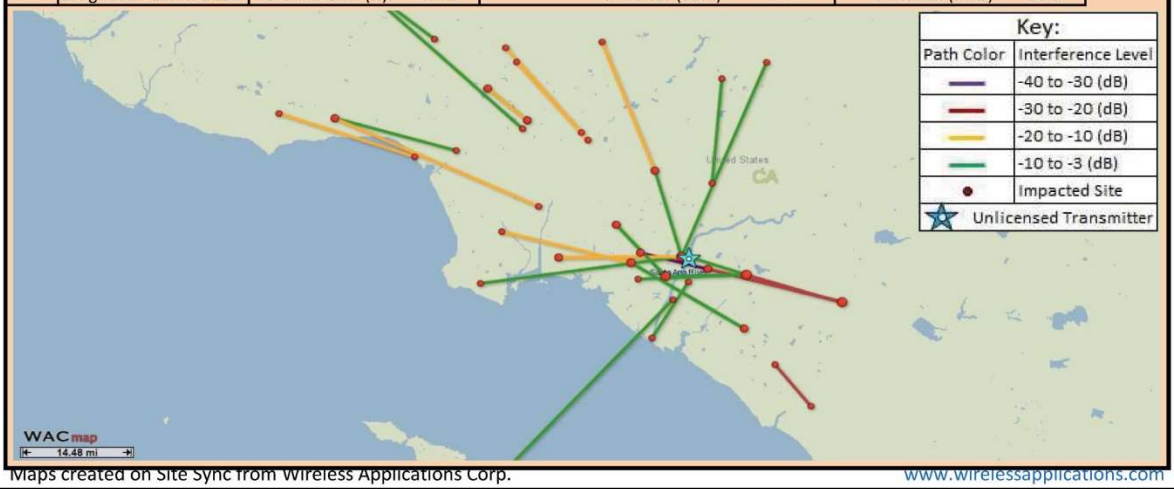
Los Angeles 5,925 MHz to 7,125 MHz



Latitude:	34.066384	Elevation AGL (ft):	50.0	Antenna Gain (dBi):	5.3	EIRP (dBm):	32.3
Longitude:	-118.231422	Ground Elev. (ft):	983.6	Tx Power (dBm):	27.0	Ch Width (MHz):	80.0

Los Angeles				Unlicensed A (quantity of impacted channels)					Unlicensed B (quantity of impacted channels)				
Interference Level->				-50 to -40	-40 to -30	-30 to -20	-20 to -10	-10 to -3	-50 to -40	-40 to -30	-30 to -20	-20 to -10	-10 to -3
Receiver Threshold Degradation->				43.1 to 33.1 (dB)	33.1 to 23.2 (dB)	23.2 to 13.3 (dB)	13.3 to 4.9 (dB)	4.9 to 1.5 (dB)	43.1 to 33.1 (dB)	33.1 to 23.2 (dB)	23.2 to 13.3 (dB)	13.3 to 4.9 (dB)	4.9 to 1.5 (dB)
Ch #	Center Frequency (MHz)	Tx Power (dBm)	EIRP (dBm)										
Ch1	5975	27	32.3	0	0	0	6	1	0	0	0	2	7
Ch2	6055	27	32.3	0	0	0	5	0	0	0	1	3	5
Ch3	6135	27	32.3	0	0	0	2	2	0	0	0	4	2
Ch4	6215	27	32.3	0	0	4	1	1	0	0	0	2	3
Ch5	6295	27	32.3	0	0	3	1	3	0	0	0	2	3
Ch6	6375	27	32.3	0	0	3	2	1	0	0	0	0	2
Ch7	6455	27	32.3	0	0	0	0	0	0	0	0	0	0
Ch8	6535	27	32.3	0	0	0	1	3	0	1	0	1	0
Ch9	6615	27	32.3	0	0	0	3	0	0	0	4	0	1
Ch10	6695	27	32.3	0	0	1	3	1	0	0	0	1	2
Ch11	6775	27	32.3	0	0	0	0	1	0	0	0	1	0
Ch12	6855	27	32.3	0	0	0	0	1	0	0	0	0	0
Ch13	6935	27	32.3	0	0	0	0	0	0	0	0	0	0
Ch14	7015	27	32.3	0	0	0	0	0	0	0	0	0	0

Latitude:	33.788486	Elevation AGL (ft):	50.0	Antenna Gain (dBi):	5.3	EIRP (dBm):	32.3
Longitude:	-117.872220	Ground Elev. (ft):	494.9	Tx Power (dBm):	27.0	Ch Width (MHz):	80.0

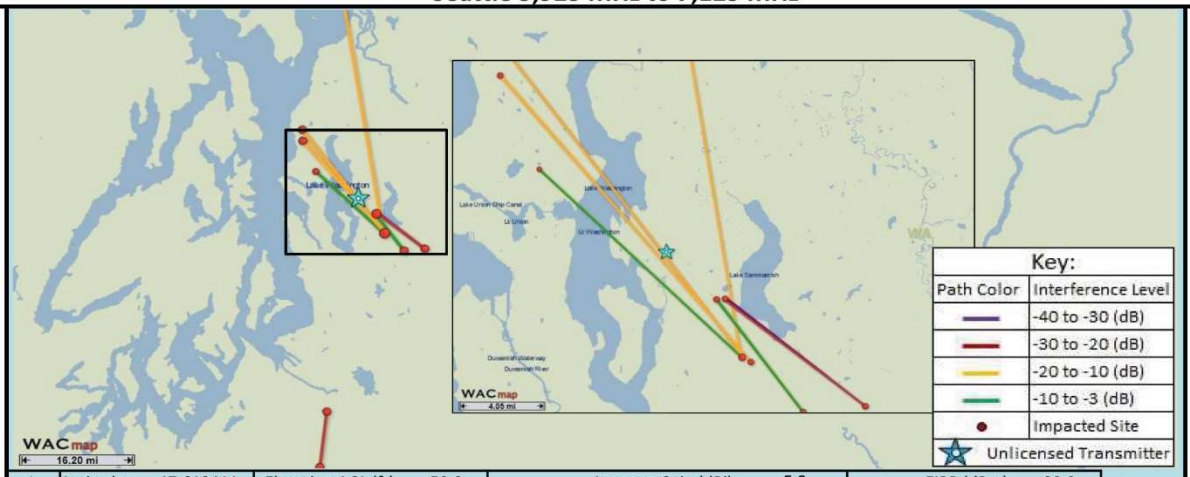


Maps created on Site Sync from Wireless Applications Corp. www.wirelessapplications.com

Figure 7 - Unlicensed 6 GHz Interference in Los Angeles

Effected Licensed Paths from 2 Unlicensed Outdoor Transmitters

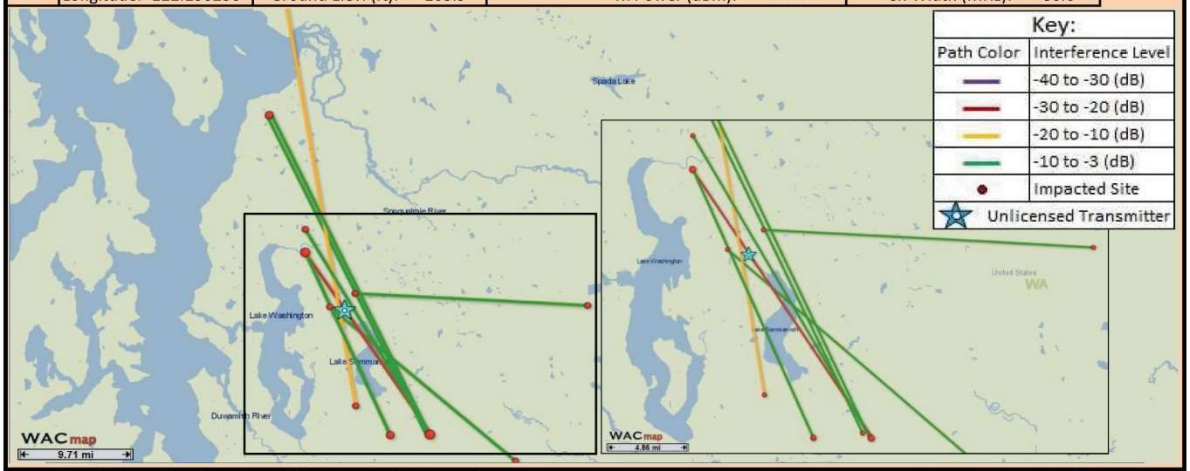
Seattle 5,925 MHz to 7,125 MHz



Latitude: 47.618411	Elevation AGL (ft): 50.0		Antenna Gain (dBi): 5.3		EIRP (dBm): 32.3
Longitude: -122.184813	Ground Elev. (ft): 452.1		Tx Power (dBm): 27.0		Ch Width (MHz): 80.0

Seattle				Unlicensed A (quantity of impacted channels)					Unlicensed B (quantity of impacted channels)				
Interference Level->				-50 to -40	-40 to -30	-30 to -20	-20 to -10	-10 to -3	-50 to -40	-40 to -30	-30 to -20	-20 to -10	-10 to -3
Receiver Threshold Degradation->				43.1 to 33.1 (dB)	33.1 to 23.2 (dB)	23.2 to 13.3 (dB)	13.3 to 4.9 (dB)	4.9 to 1.5 (dB)	43.1 to 33.1 (dB)	33.1 to 23.2 (dB)	23.2 to 13.3 (dB)	13.3 to 4.9 (dB)	4.9 to 1.5 (dB)
Ch #	Center Frequency (MHz)	Tx Power (dBm)	EIRP (dBm)										
Ch1	5975	27	32.3	0	0	0	2	0	0	0	1	0	1
Ch2	6055	27	32.3	0	0	1	1	0	0	0	0	1	0
Ch3	6135	27	32.3	0	0	0	0	0	0	0	0	0	2
Ch4	6215	27	32.3	0	0	1	0	0	0	0	0	1	0
Ch5	6295	27	32.3	0	0	0	0	0	0	0	0	0	1
Ch6	6375	27	32.3	0	0	0	0	0	0	0	0	0	2
Ch7	6455	27	32.3	0	0	0	0	0	0	0	0	0	0
Ch8	6535	27	32.3	0	0	0	0	1	0	0	0	0	0
Ch9	6615	27	32.3	0	1	1	0	1	0	0	0	1	1
Ch10	6695	27	32.3	0	0	0	0	2	0	0	0	0	1
Ch11	6775	27	32.3	0	0	0	1	1	0	0	1	0	0
Ch12	6855	27	32.3	0	0	0	0	0	0	0	0	0	0
Ch13	6935	27	32.3	0	0	0	0	0	0	0	0	0	0
Ch14	7015	27	32.3	0	0	0	0	0	0	0	0	0	0

Latitude: 47.669521	Elevation AGL (ft): 50.0		Antenna Gain (dBi): 5.3		EIRP (dBm): 32.3
Longitude: -122.130230	Ground Elev. (ft): 163.9		Tx Power (dBm): 27.0		Ch Width (MHz): 80.0

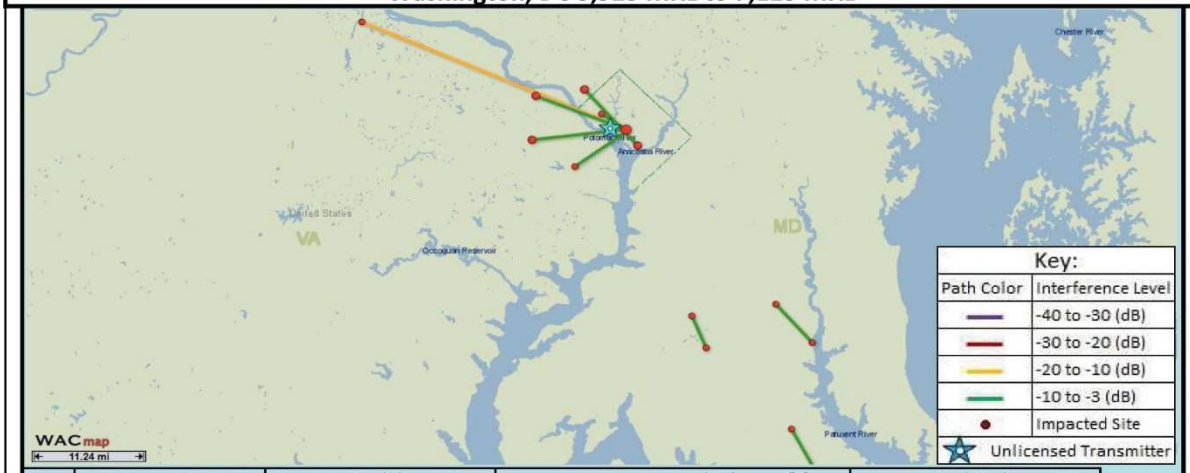


Maps created on Site Sync from Wireless Applications Corp. www.wirelessapplications.com

Figure 8 - Unlicensed 6 GHz Interference in Seattle

Effected Licensed Paths from 2 Unlicensed Outdoor Transmitters

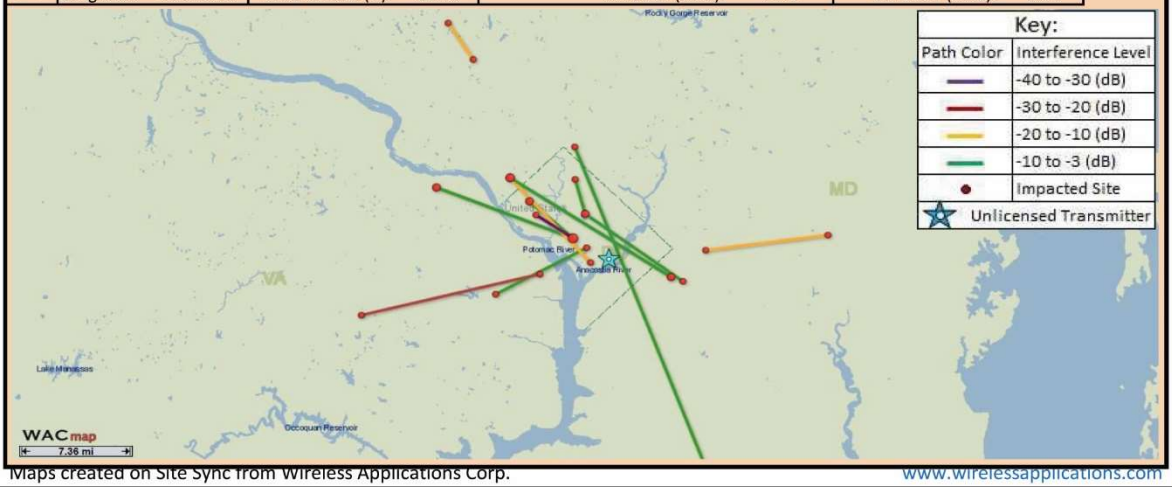
Washington, DC 5,925 MHz to 7,125 MHz



Latitude:	38.904351	Elevation AGL (ft):	50.0	Antenna Gain (dBi):	5.3	EIRP (dBm):	32.3
Longitude:	-77.057849	Ground Elev. (ft):	108.1	Tx Power (dBm):	27.0	Ch Width (MHz):	80.0

Washington, DC				Unlicensed A (quantity of impacted channels)					Unlicensed B (quantity of impacted channels)				
Interference Level->				-50 to -40	-40 to -30	-30 to -20	-20 to -10	-10 to -3	-50 to -40	-40 to -30	-30 to -20	-20 to -10	-10 to -3
Receiver Threshold Degradation->				43.1 to 33.1 (dB)	33.1 to 23.2 (dB)	23.2 to 13.3 (dB)	13.3 to 4.9 (dB)	4.9 to 1.5 (dB)	43.1 to 33.1 (dB)	33.1 to 23.2 (dB)	23.2 to 13.3 (dB)	13.3 to 4.9 (dB)	4.9 to 1.5 (dB)
Ch #	Center Frequency (MHz)	Tx Power (dBm)	EIRP (dBm)										
Ch1	5975	27	32.3	0	0	0	0	0	0	1	0	0	3
Ch2	6055	27	32.3	0	0	0	0	3	0	0	0	1	2
Ch3	6135	27	32.3	0	0	0	0	0	0	0	0	0	2
Ch4	6215	27	32.3	0	0	0	0	1	0	0	0	0	1
Ch5	6295	27	32.3	0	0	0	2	2	0	0	0	1	1
Ch6	6375	27	32.3	0	0	0	0	1	0	0	0	0	0
Ch7	6455	27	32.3	0	0	0	0	0	0	0	0	0	0
Ch8	6535	27	32.3	0	0	0	0	0	0	0	0	0	0
Ch9	6615	27	32.3	0	0	0	1	3	0	0	0	1	3
Ch10	6695	27	32.3	0	0	0	0	0	0	0	0	0	1
Ch11	6775	27	32.3	0	0	0	0	0	0	0	1	0	1
Ch12	6855	27	32.3	0	0	0	0	0	0	0	0	0	1
Ch13	6935	27	32.3	0	0	0	0	0	0	0	0	0	0
Ch14	7015	27	32.3	0	0	0	0	0	0	0	0	0	0

Latitude:	38.881610	Elevation AGL (ft):	50.0	Antenna Gain (dBi):	5.3	EIRP (dBm):	32.3
Longitude:	-76.985714	Ground Elev. (ft):	226.0	Tx Power (dBm):	27.0	Ch Width (MHz):	80.0



Maps created on Site Sync from Wireless Applications Corp. www.wirelessapplications.com

Figure 9 - Unlicensed 6 GHz Interference in Washington, DC

Conclusion

Wireless Applications Corp. (WAC) has demonstrated how a couple of unlicensed outdoor transmitters would impact the 6 GHz band in five cities across the US. If one then extrapolates the simulated results to hundreds of unlicensed transmitters in these areas, then the quantities will be multiplied by hundreds. This would effectively make licensed microwave an unusable and/or unreliable mode of communication.

With the 6GHz band eventually being ruled by unlicensed and undocumented networks, there will be a lack of accountability as there will be no way to determine where an interference signal is coming from or who owns the equipment. The FCC would also look to lose all monetary fees associated with future microwave licensing in 6 GHz as planning a reliable network or long-haul will become impossible to guarantee and impractical to invest in.

We strongly agree with the Fixed Wireless Communications Coalition that unlicensed devices at 6 GHz will cause disastrous interference to current microwave operations. We ask the FCC not to authorize unlicensed devices in the 6 GHz microwave bands.

Respectfully submitted,

Arman Kolukcija
Sr. MW Engineer